

Research of Stalled Operational Modes of Axial-Flow Compressor for Diagnostics of Pre-Surge State

Authors : F. Mohammadsadeghi

Abstract : Relevance of research: Axial compressors are used in both aircraft engine construction and ground-based gas turbine engines. The compressor is considered to be one of the main gas turbine engine units, which define absolute and relative indicators of engine in general. Failure of compressor often leads to drastic consequences. Therefore, safe (stable) operation must be maintained when using axial compressor. Currently, we can observe a tendency of increase of power unit, productivity, circumferential velocity and compression ratio of axial compressors in gas turbine engines of aircraft and ground-based application whereas metal consumption of their structure tends to fall. This causes the increase of dynamic loads as well as danger of damage of high load compressor or engine structure elements in general due to transient processes. In operating practices of aeronautical engineering and ground units with gas turbine drive the operational stability failure of gas turbine engines is one of relatively often failure causes what can lead to emergency situations. Surge occurrence is considered to be an absolute buckling failure. This is one of the most dangerous and often occurring types of instability. However detailed were the researches of this phenomenon the development of measures for surge before-the-fact prevention is still relevant. This is why the research of transient processes for axial compressors is necessary in order to provide efficient, stable and secure operation. The paper addresses the problem of automatic control system improvement by integrating the anti-surge algorithms for axial compressor of aircraft gas turbine engine. Paper considers dynamic exhaustion of gas dynamic stability of compressor stage, results of numerical simulation of airflow flowing through the airfoil at design and stalling modes, experimental researches to form the criteria that identify the compressor state at pre-surge mode detection. Authors formulated basic ways for developing surge preventing systems, i.e. forming the algorithms that allow detecting the surge origination and the systems that implement the proposed algorithms.

Keywords : axial compressor, rotation stall, Surg, unstable operation of gas turbine engine

Conference Title : ICTFD 2015 : International Conference on Turbomachinery and Fluid Dynamics

Conference Location : Paris, France

Conference Dates : February 23-24, 2015